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Evolution of Nurses' Social Representations of Hospital Hygiene: From Training to Practice[1]

Abstract

Nurses' social representations of hospital hygiene were analyzed. A cross-sectional method was used to compare and analyze the social representations of the concept domain of "hospital hygiene" across three independent groups of participants (N=744). The groups included: (a) professional nurses (N=114); (b) student nurses (N=315); and (c) psychology students (N=315). Comparisons were drawn: (a) between professionals and students; and (b) between student nurse cohorts at three different levels (years) of training. The results show an ongoing evolution of the social representations of hospital hygiene during training and in the course of professional practice. The representation of hospital hygiene is structured around the element "cleanliness" at the beginning of training and around "asepsis" at the end of training. An increased specialization of vocabulary pertaining specifically to hospital hygiene is also observed. A comparative analysis between students and professionals shows a lower number of common lexical associations in the student group. A discussion of how these

[1] The authors wish to thank the experts who helped to improve the first draft of this study.

results are related to other research in cognitive ergonomics and the analyses of dialogues involving professional interactions between experts and novices is provided.

Keywords: Social representations, hygiene, health, nosocomial infections, word association task, lexical analysis, similarity analysis.

Résumé

L'objectif de cette recherche est d'analyser l'évolution de la représentation sociale de l'hygiène durant la formation des infirmières. Nous utilisons une méthode transversale, les échantillons sont indépendants. Les réponses des 744 participants répartis au sein de trois populations sont comparées : un groupe de professionnel infirmiers (N=114) et deux groupes d'étudiants. Le premier groupe d'étudiants est spécialisé en soins infirmiers (N=315), le second a le même niveau d'étude mais pas dans cette spécialisation (N=315). Une comparaison est faite entre les trois groupes, puis, pour les étudiants spécialisés, entre chaque niveau de la formation.

Les résultats font apparaître une évolution de la représentation au cours de la formation et durant la professionnalisation. Au début de la formation, la représentation est structurée autour de l'élément propreté à la fin de la formation autour de l'élément asepsie. Il y a une spécialisation du lexique qui réfère à l'hygiène hospitalière. Parallèlement, on note qu'entre les étudiants et les professionnels apparaît une diminution du nombre d'éléments associés par les sujets de manière consensuelle. Ces résultats sont mis en relation avec les recherches sur les dialogues entre opérateurs experts en situation de travail, dans les études d'ergonomie cognitive.

Mots clefs : Représentations sociales, hygiène, santé, infections nosocomiales, tâche d'associations verbales, analyse lexicale, analyse de similitude.

Introduction

Objectives and Relevance of the Research

This study was conducted within the Network for the Fight against Nosocomial Infections (Réseau de Lutte contre les Infections Nosocomiales: RFCLIN), with a specific focus on the infections contracted by patients during a period of hospitalization in a healthcare institution. Practice audits have highlighted problems concerning the application of hygiene protocols by medical and nursing staff.

The general purpose of this research was to compare the cognitive representations of hospital hygiene of three levels of nursing students to those of professional nurses (both new entrants and experienced healthcare workers) and to examine their evolution with increased practice in order to gain insights that would lead to recommendations for improved health staff training.

Context of the Research

Nosocomial Infections in Hospitals

The fight against Nosocomial Infections (NI), i.e., infections contracted in hospitals, has become a major priority in hospitals throughout France. Reasons for this include: (a) the recent publication of alarming statistics (nearly 9000 people – i.e., almost 7% of hospital patients – die every year as a result of a NI in French hospitals[2]); and (b) the creation of an accreditation procedure by the French Higher Health Authority (*Haute Autorité de Santé*: HAS) led by the French National Agency of Health Accreditation and Evaluation (*Agence Nationale d'Accréditation et d'Evaluation en Santé*: ANAES) aimed at evaluating both the safety and the quality of healthcare provision.

The fight against NIs began in 1988 as a result of the creation of the Committees for the Fight against Nosocomial Infections (CLIN) in healthcare institutions. These committees

[2] According to government statistics; see http://www.sante.gouv.fr/htm/pointsur/nosoco/34 980901.htm

are coordinated by larger bodies such as the National Technical Committee for the Fight Against Nosocomial Infections (*Comité Technique National de Lutte contre les Infections Nosocomiales*: CTIN,) and the Centre for the Coordination of the Fight Against Nosocomial Infections (*Centres de Coordination de Lutte contre les Infections Nosocomiales*: CCLIN). There are also several intermediary bodies, including the National Network for the Identification, Investigation and Monitoring of Nosocomial Infections (*Réseau National d'Alerte, d'Investigation et de Surveillance des Infections Nosocomiales*: le RAISIN,) and a number of regional networks, such as the RFCLIN. The role of these organizations is to carry out practice audits on medical and nursing staff and to evaluate the appropriate use of care-related techniques and procedures.

In practice, prevention specifically involves the provision of training for students and nursing staff. Initial training in nursing theory and practice is largely provided by the French Nursing Institutes (*Instituts en Soins Infirmiers*: IFSI) and lasts three years. Successful trainees are awarded the *Diplôme d'Etat* (national certification) in nursing, covering both the theory and the practice of nursing. Student nurses undertake theoretical training alternating with clinical placements in hospitals. It is important to note that, in quantitative terms, less than 3% of the hourly volume of training is directly related to hygiene[3], although training in this area is provided in some form across all modules. Contact with hospital practice and the application of hygiene protocols is ensured during the clinical placements which students are required to undertake in different hospital departments. The hourly volume of clinical placements increases throughout training, reaching nearly 50% of the total duration of training, i.e., 68 weeks. Students may begin working as qualified nurses once they have successfully validated their diploma at the end of the third year of training. Continuing

[3] Training in this area amounts to 60 hours spread over a period of 3 three years. The topics addressed include hospital hygiene (definition, concepts in microbiology, infections, decontamination, disinfection, sterilization, etc.) and environmental hygiene (waste: conditioning, collection, treatment…), pollution, planning and development.

education in hygiene is provided in the form of themed workshops. Longer training courses are also available, such as the University Diplomas in Hospital Hygiene (*Diplômes Universitaires d'Hygiène Hospitalière*).

Although the issue of hygiene is addressed in basic nursing courses and throughout continuing education, audits show that the NI rate remains high. In this study, with the goal of finding underlying factors that might contribute to this problem, we focused on an analysis of representations (for example, attitudes towards hygiene practices) that might account for the continuing high NI rate.

Attitudes to Hygiene and Hygiene Practices in Hospitals

There is a substantial body of literature on this issue, for the most part, focusing on the chief carrier of NI – hands. The more specific issue usually addressed in the literature is the perception of hand-cleaning practices.

It appears that while healthcare workers state largely favourable attitudes towards hand-cleaning practices, observed compliance rates are below 30% (see McGuckin, Waterman & Govednik, 2009). Analysis of the reasons given by professionals for the lack of compliance to hand-cleaning practices highlights several explanatory factors, including: work conditions (lack of time), infrastructures (lack of equipment), training (inadequate), human environment (superiors, colleagues, unscrupulous patients...) and the health of medical and nursing staff (skin irritations caused by frequent hand cleaning). The most frequently cited cause of compliance is the presence of a conscientious hierarchical superior (Akyol, 2007; Pessoa-Silva, Posfay-Barbe, Pfister, Touveneau, Perneger & Pittet, 2005). An observation study conducted in Switzerland by Pittet, Simon, Hugonnet, Pessoa-Silva, Sauvan & Perneger (2004) demonstrated that lack of equipment at hand-cleaning stations or of hydro-alcoholic solutions was not the only explanatory factor, since compliance rates remain low (57%) even when departments are adequately equipped. The most frequently cited reasons

for compliance practices include: awareness of being observed, the sense of being an example for colleagues, the need to practice hand-cleaning after contact with patients, and finally, access to hydro-alcoholic solutions.

The cited causes of non-compliance among student nurses tend to converge: undemanding and undisciplined clinical placement supervisors; patients and families with little regard for hygiene; absence of training in hand-cleaning techniques; and an inadequate level of family education. However, compliance increases when clinical placement supervisors demonstrate high standards of supervision and training (Lusardi, 2007).

The studies outlined above suggest, first of all, that stated attitudes of non-compliance are connected with the work environment. Yet, even in the event of favourable work conditions, there is no significant increase of the compliance rate. Secondly, compliance practices observed in practice are merely superficial since they tend to involve 'compliance' and 'non-internalization', to use the terminology coined by Kelman (1958). Instead of arising out of a firm belief in the validity of the norms defined by protocols, compliance tends to be the result of a sense of social desirability: an individual produces a particular behaviour because s/he acts in accordance with the expectations of his/her superiors.

Because there may be compliance in the effective application of hygiene protocols even when norms are not internalized, we addressed the issue from a different perspective. We have examined the reasons for non-internalization. In addition to focusing on social factors (such as the presence of a third party during a care-related procedure or intervention) or environmental factors (such as the presence of hand-cleaning stations or hydro-alcoholic solutions), we also adopted a socio-cognitive perspective in seeking to answer the following questions: (a) How is knowledge about hygiene organized, and what are the relations between the different strands of such knowledge?; (b) How is scientific knowledge integrated within pre-existing 'naive' knowledge?; (c) How does scientific knowledge

evolve and develop through training, and how does it develop subsequently in practice?; and (d) Can such knowledge impede the direct implementation of hospital protocols?

More specifically, these questions entail the articulation of scientific thought and naive thought, as well as the dynamics governing the relation between the two. To provide some answers to these issues, we focus on social and professional representations and, more specifically, on research that has examined the elaboration and evolution of these representations.

Theoretical Framework

Social Representations

Social representations reflect common sense knowledge within a particular group, and include opinions, procedures and knowledge. Social representations pertain to a wide range of social objects and serve a practical purpose insofar as they facilitate communication between individuals and enable a faster processing of information originating from the social environment (Jodelet, 1989; Howarth, 2006; Jovchelovitch, 2007).

Among the factors examined in the study of social representations, the processes governing the evolution and constitution of knowledge are paramount. Two chief causes of evolution have been highlighted from a structural perspective (Moliner, 2001): (a) the transformation of practices (or the application of *new practices*) (Guimelli & Jacobi, 1990; Tafani & Souchet 2002); and (b) the encounter of *elements of knowledge* with social influence (Roussiaux & Soubiale, 1996). Change may occur as a result of a direct challenge to elements of the *central* system (Mugny, Moliner & Flament, 1997) or of the *peripheral* system (Guimelli, 1989), and are demonstrated by the modification of at least one of the central elements of the representation (Abric, 1994).

The elaboration of a representation – and more specifically the integration of scientific knowledge within common sense knowledge – has been a central focus of research

in this area from the very outset. Moscovici (1961) carried out an analysis of two key processes: *objectification* (i.e., the simplification of an object based on a selection of particular characteristics and their appropriation within a specific field of application) and *anchoring* (integration within a network of existing knowledge). What was initially deemed to be alien is made familiar through objectification and anchoring (Moscovici, 1961). Moscovici demonstrated how a new and abstract object – i.e. psychoanalysis – gradually became familiar and operational through exposure in the press. Since it is dependent on the specific social utility attributed to it, the meaning of the elements attached to the object in question is entirely original. But it also depends on the threat which the introduction of this object may entail for the knowledge established and shared by a group. In psychoanalysis, although the terms "Complex", "Repression" and "Unconscious" remain in use, they have nonetheless acquired a specific meaning, while the term "Libido" has disappeared altogether. The "Unconscious" becomes that which is hidden or concealed, "Repression" results from the tension between the conscious and the unconscious, and a "Complex" is the result of Repression. The same analysis applies to other objects, such as AIDS or mental illness (Jodelet, 1991; Lavigne, 1996; Morin, 1999…).

Moscovici & Hewstone (1983) later provided a more detailed analysis by defining the specific characteristics of two different modes of thought: scientific thought and common sense thought. Scientific thought is characterized by concepts and is based on logic and rationality and on procedures governing the validation of hypotheses, while common sense thought is constructed collectively and is based on norms and symbols. There is no radical opposition between the two modes since scientific thought is deemed to feed into common sense thought, while common sense thought is deemed to insinuate itself into scientific thought (see Bangerter, 1995).

The media play a key role in the development of social representations (Moscovici, 1961) insofar as they integrate and popularize abstract and unfamiliar scientific concepts, such as psychoanalysis, GMOs and biotechnologies. Such objects may be appropriated, transformed and incorporated, or they may be rejected as a result of social resistance (see Brown, Chapman & Lupton, 1996; Joffe, 2002). Green & Clemence (2008) highlighted the process experimentally in an ingenious study that combined the rumour paradigm and the theory of social representations. The task involved transmitting a scientific message in a chain of communication. The results of their research demonstrated that the transmission gradually produced a loss of scientific terminology (expert language) and an increased use of terms drawn from ordinary language. The linguistic analysis carried out in this study demonstrated that the initial meaning is transformed by including elements of naive knowledge.

Professional Representations

The evolution or elaboration of representations can also be addressed by focusing on professional representations from first-degree training to professional practice.

Professional representations (Piaser, 1999; Labbé, Ratineau, & Lac, 2007) are a sub-set of social representations and pertain to particular objects within a specific professional sphere. Professional representations are shared by a particular professional group. Their role is to process information in work situations (Piaser, 1999) and to organize activity (Labbé *et al.*, 2007). Knowledge is common not merely because individual members of the professional sphere in question share the same professional occupation but also because they have undergone similar training (Bataille, 2000).

To highlight the evolution or elaboration of professional representations, researchers tend to resort to cross sectional analyses, i.e., several independent groups of individuals are compared at different points in the time-line of their professional training and practice. Cross

sectional approaches are particularly useful inasmuch as they avoid the biases entailed by test/retest methods and are easier to implement, while still indicating trends among populations compared at different levels of training. But they do have one significant limitation since they make it impossible to attribute the evolution of a given representation merely to progression to the next level. Sufficiently large homogeneous samples are needed in order to compensate for this bias. Longitudinal analyses are based on a monitoring of cohorts, and are less common. Groups are questioned and observed over a sufficiently long enough period to highlight the evolution of a representation, which tends to increase the amount of effort and resources required to conduct the research. Such methods lay themselves open to one fundamental criticism – namely that conducting the same test on several occasions within the same population is likely to generate significant biases, such as the effects of training, habit, and saturation, in addition to biases related to the human tendency to want to be compliant and consistent, to which might be added the limitations caused by potential dropout rates and deaths (see Dardenne, Haslan, McGarty, & Yzerbyt, 2001).

Many studies have examined the impact on professionals' representations of their work, or of students' representations of their work, after introducing new practices or altering established practices. In a study of nurses' representations of their role, Guimelli & Reynier (1999) showed that, in terms of their representations of their own roles, the introduction of new practices resulted in a gradual structural organization of their representation. The same result was found by Moliner (1998) in an analysis of the representation of the function of nurses among student nurses, young professional nurses and experienced professional nurses. Structuring resulted in a modification of the central core between the three groups under study, including between young professionals and experienced professionals (in spite of the fact that they engage in the same professional practices). Thus, the length of professional

practice is another factor that needs to taken into account. Finally, Labbé et al. (2007) highlighted the effect of the level of engagement of individuals in these practices. A higher level of engagement resulted in an increase in the number of themes and the number of connections within an associative network.

Focusing more specifically on the effects of training, Correia, Broderick & Walker (2003) studied the development of the representation of mental illness during training in psychology. Their goal was to establish the degree to which naive knowledge tends to persist by comparing three groups of participants: psychology students, students in other subject areas, and practising psychologists. A comparative analysis was also conducted between individuals at different stages of training. The results pointed to a number of shared elements. At all stages, a mental illness implied the "need for assistance", "psychological dysfunction", and negative emotions. However, education and training led to a shift from a stereotypically negative perception associated with the naive concept of the "crazy person" towards a more positive perception that integrates scientific knowledge. However, the study did not include a precise analysis of how the representational content was structured.

The studies conducted by Falzon (1989) and Vergely (2004), which are rooted in cognitive ergonomics, shed light on the effects of training and practice on language productions, and highlight the construction of specialized vocabulary by professional experts in a specific area. The language used by professional experts is described as "operative language" since it is highly specialized and refers to well-identified situations related to a specific professional activity. According to Falzon (1989), an operative language has several characteristics. Because it entails shared mental representations, an operative language is generally shared by professionals involved in the same professional activity, and it is specific to the profession since it is based on systems of reference that are specific to the group in question. In terms of lexical range and syntactic structure, an operative language is restricted

to a small number of units (containing fewer language units than ordinary language) and is more specialized (the words used in an operative language are rare and may, in some cases, not be used at all).

So far, here has been a paucity of research conducted on the representation of hygiene. Zérillo (1998) conducted interviews with high school (*lycée*) students and student nurses in order to highlight the relations between representations of hygiene, in general, with those of body, medical, and collective hygiene. Based on several studies that used different techniques of data collection, Zérillo showed that the representation of hygiene is an autonomous representation and is centered around two aspects – "the prevention of illnesses" and "well-being". The first study involved a word association task that included four terms referring to hygiene used as inductor items. A prototypical analysis was used to assess the induced items (Vergès, 1992). The analysis indicated that the term "cleanliness" was stable and recurrent and was cited early on in the chain of association. It was, therefore, deemed to be central. The peculiarity of this term is that it covers both identified themes (i.e. "the prevention of illnesses" and "well-being"). Based on the analysis of "themata" conducted by Moscovici & Vignaux (1994), Zérillo argued that the central system of the representation of hygiene is generated by the notion of cleanliness, "which is itself dependent on a common generic theme that originates invariably from assumed knowledge**,** or basic and prior common ideas. It is these basic and prior common ideas that inform and motivate social regimes of discourse, the effect of which will be that on every occasion we will need to adopt common ideas or at the very least come to terms with them" (Moscovici & Vignaux, 1994, p.35).

Lecigne & Quintard (2008) focused on the representation of Nosocomial Infections among hospital personnel, highlighting two explanatory factors that accounted for the positions adopted towards the object in question: professional status and the level of training.

In the case of professional training, the authors noted that when they were asked about nosocomial infections, hospital service agents (orderlies) and female nursing assistants tended to focus on issues related to professional demands that interfered with the implementation of the best hygiene practices (e.g., lack of means, lack of time...). Nurses and doctors, in contrast, tended to view specific healthcare practices as potential problem sources. In terms of training, the authors noted that the higher the level of training, the more likely healthcare workers were to consider the fight against nosocomial infections to be effective. An experiment with nurses and nursing assistants was conducted. Both groups of healthcare workers were involved in either standard training or "engaged" training. Standard training included aspects of traditional training in terms of the fight against nosocomial infections. In engaged training, members of staff implemented measures designed to fight against infections within their department that were determined within the training group. The assessment concerned self-reported practices. The results indicated that healthcare workers involved in engaged training were more likely to report that they used prevention practices and less likely to refer to material obstacles than those who had undergone standard training. Another result is worth noting: professionals who had completed standard training were more likely to invoke internal attributions to account for the occurrence of nosocomial infections. The authors concluded that standard training plays a part in fostering guilt among healthcare workers, whereas engaged training encourages members of staff to become engaged in developing and implementing new practices, which tends to alter their representations of nosocomial infections.

Taken together, these studies demonstrate that an encounter with new scientific knowledge involves a process of integration and appropriation that tends to have two effects: at first, a disengagement with expert language in favor of common sense language, in which meaning is "adapted" to account for new knowledge (Greene & Clemence, 2008) then

second, a re-appropriation of the terminology of scientific language with a meaning shaped and modified to make it compatible with prior knowledge (Moscovici, 1961). Focusing more directly on expert language, research conducted by Falzon (1989) highlighted the existence of a common operative language characterized by a limited and highly specific lexicon within a particular area.

Research on social representations provides information about the factors involved in the evolution of the specific structure of a representation: a modified structure may be the result of the alteration or introduction of new practices, but it may also arise out of an encounter with new knowledge. The result is the modification of the most central elements (e.g. Guimelli & Reynier, 1999). Finally, research on nosocomial infections (Lecigne & Quintard, 2008) highlights the impact of training and of belonging to a professional group on the representation of nosocomial infections. Zérillo (1998), focused more directly on the problem of hygiene. While the results of that study did not provide conclusions about the evolution of the observed representations, the results did show that there appears to be a central element in the representations – the concept of cleanliness.

Drawing from research on social representations, and more specifically, on the effects of practice experience, in this study we will examine different representations among participants with some professional experience of hospital hygiene (students and professionals) and participants with no such experience. We will also examine the representations of specialist students according to their three levels of training. It is predicted that differences will be apparent in the lexicon, content, and structure of the prevailing representations. In terms of lexicon, and in connection with the notion of operative language, this research predicts (Hypothesis 1) a less extensive vocabulary, a greater number of words generated collectively and, in contrast, a smaller number of words generated individually among individuals who have undergone common training and should have common hygiene

practices (professional nurses and, to a lesser degree, student nurses) than individuals with no professional experience or training in hospital hygiene (students in other disciplines). At the level of content, we predict (Hypothesis 2) a greater number of terms specifically related to hospital hygiene in the two groups with some knowledge and experience of hospital hygiene than in the group of participants with no such knowledge or experience. In contrast, it is predicted that the non-specialist group will make use of a greater number of lexical items related to their own experience of hygiene, that is to say, body hygiene and domestic hygiene. At the level of structure, and in connection with studies that focus on hygiene, we predict (Hypothesis 3) that, for all three groups, the concept of cleanliness will be central. However, for the two groups with some professional experience and knowledge of hospital hygiene, we predict that the concept domain will be composed of elements related to this expertise. In the group with no professional experience or knowledge of such expertise, we predict that the concept domain will be composed of elements connected with body hygiene and domestic hygiene. Finally, in view of their training, their encounter with new information, and their increasing experience of hospital hygiene, we predict (Hypothesis 4) a change in the observed representation throughout the three years of training undertaken by student nurses. We predict that this will result in: (a) the use of an increasingly specialized vocabulary that is specific to hospital hygiene; and (b) the progressive evolution of a structured organization of elements that are specific to hospital hygiene.

Method

Participants

The participants consisted of 744 individuals distributed across three groups, including: (a) qualified professional nurses: PRO, (N=114)[4]; (b) Students Specialized in Nursing: SSN,

[4] Access to a group of 315 nursing professionals was not possible.

(N=315); and (c) Students at the same level of training but Not Specialized in Nursing: SNSN, (N=315).

The qualified professional nurses had worked in health care institutions for at least 3 years. All participants were between 26 and 57 years-old (mean age: 37.2). The PRO group included women (95%) and men (15%). All of the participants in the PRO group held national certification (*Diplôme d'Etat*) in nursing and implemented standard hygiene practices on a *regular* basis. Participants in this group had also taken part in at least one training session in hygiene since the beginning of their career in healthcare.

The students specialized in nursing are trained in the technical practices of hospital hygiene as part of their three-year degree in nursing. Students in this group were required to implement hygiene practices on an *intermittent* basis during their clinical placements. Participants in the SSN group were between 18 and 25 years-old (mean age: 19.5) and included female students (90%) and male students (10%). A distinction was drawn between three cohorts of nurses in training according to their year of study. Per cohort, 105 student nurses were selected randomly from within each year.

Students not specialized in nursing were studying for a degree (*licence*) in psychology. These students served as the reference group and had no practical experience or knowledge of hospital hygiene. Participants in this group were comparable to the SSN group in terms of geographical origin, age, and male/female distribution. They were between 18 and 26 years-old (mean age: 20.06). The non-specialist group included females (89%) and males (11%). Again, a distinction was drawn between the psychology student cohorts at three different levels (years) of study. Per cohort, 105 students were selected randomly from within each year.

Data Collection

The data collection process involved presenting a questionnaire of word associations. Participants were required to cite the first 10 words (or phrases) that came to mind when hearing the inductor item "hygiene".

The first page of the questionnaire specified the object of the study ("hygiene") and the general framework of the research ("a survey of nosocomial infections in hospitals"). An oral definition of the phrase "nosocomial infections" was provided for the benefit of the group of psychology students.

Treatment of Results

Using Statistica® software, $\chi 2$ were calculated for the lexical statistics and Jaccard indices were calculated for the similarity analysis. Initially, an analysis of lexical data was carried out by examining the distribution of connections for the words associated by the three groups. Variability and intra-group consensus were assessed by calculating two indices: (a) the number of Hapax (to measure variability); and (b) the Binomial Test (to measure consensus). These indices are presented in the paragraph below. Secondly, a similarity analysis was carried out. The results are presented in the form of maximum trees (Flament, 1081; Doise, Clemence & Lorenzi-Cioldi, 1992; Verges & Bouriche, 2001, 2003; Moliner, Rateau & Cohen-Scali, 2002; Abric, 2003...).

Statistical Analysis of Lexical Data

The statistical analysis of lexical data involved a twofold process. An assessment of the variability of intra-group responses was carried out by comparing the number of Hapax produced by participants in all three groups. A Hapax is a term uttered by just one participant within a group (see Lebart & Salem, 1988). The higher the number of Hapax, the greater the degree of variability and, therefore, the lower the degree of consensus. A statistical comparison of the number of Hapax in each of the three groups was conducted using the $\chi 2$ test.

The next stage involved an analysis of the level of consensus. The number of words shared by participants and uttered on the basis of a probability differing significantly from a random distribution was calculated. A binomial test was used for the purposes of the statistical analysis.

$$p(k) = P(X = k) = \binom{n}{k} p^k q^{n-k}$$

A binomial test involves a calculation of probability and takes into account the number of participants, the number of words associated by different participants, and the total number of different words associated by participants (see Salès-Wuillemin, 2005; Morlot & Salès-Wuillemin, 2008). For every population, a binomial test enables a precise measurement of the minimum number (k) required to exceed the probability P of a random distribution of the associated words. For example, k=2 means that a word associated by at least two individuals is shared socially by the members of the group in question to a significant degree. A binomial test was used to determine the number of words produced consensually (i.e., the number of words situated above the binomial threshold). A statistical comparison of the number of consensual words in the three groups was conducted using the $\chi 2$ test.

Similarity Analysis and Maximum Trees

A similarity analysis was carried out using a corpus of words situated above the binomial threshold. The similarity analysis was elaborated by Flament (1981) as part of an inquiry into social representations. The purpose of a similarity analysis is to assess the number and strength of the connections between the strands of knowledge which constitute a social representation (for a more detailed presentation, see Vergès & Bouriche, 2001). The central position of an element within the network is dependent on its connectivity, i.e., the number of total connections with other elements and the strength of such connections.

The analysis was conducted in four stages: (1) a prototype analysis designed to identify the target items; (2) the creation of a squared matrix to code the target items in a binary form; (3) the calculation of a Jaccard index to assess the degree of similarity between the target items and the elaboration of a similarity matrix; and (4) a graphical representation of the target elements in the form of a graph (maximum tree).

The purpose of a prototype analysis (Vergès, 1992) is to draw a distinction between the most frequently cited elements and the least frequently cited elements – i.e., to draw a distinction between the earliest cited elements in the word association task and the items uttered at a later stage. Four different categories can be distinguished: the most frequently and earliest cited elements (central zone); the least frequently cited elements which, when they are cited, are uttered early on (contrast zone); elements that are frequently cited, though at a later stage (first periphery); and finally, less frequently cited items uttered at a late stage (second periphery). The elements targeted for the similarity analysis are identified using the prototype analysis. Only the elements located in the first three zones were used in this research.

The squared matrix is obtained by cross-relating participants and target items. Every item was coded in binary form by ascribing 1 to every instance where the item appears in the pattern of the first three ranks of evocation and 0 in other cases (irrespective of the rank of evocation). The presence of the item within the pattern of the first three ranks of evocation is an indicator of a high degree of availability.

The Jaccard index is a similarity index measured by calculating the Phi contingency coefficient, with the proviso that it allows for a specific focus on co-occurrence between items without having to take into account co-absence (see Degenne & Vergès, 1973). The

following formula was used: Number of co-occurrences[5]/Number of choices concerning either item within the pair[6].

For every pair of items, the Jaccard index evaluates the proportion of participants uttering both terms together in the same pattern of the first three ranks in relation to the total number of participants distributed across the three modalities (co-presence or presence of just one of the two items, the first followed by the second). The final modality (co-absence) is not taken into account in the Jaccard index. These calculations entail the elaboration of a similarity matrix between all the target items.

The similarity matrix is used to construct the maximum trees using Kruskal's algorithm. The vertices of the graphs are the items, and the edges are the values of the similarity index. Kruskal's algorithm is used to construct the graph. A selection of indices by decreasing value is carried out. Only the relations between items with the highest values are retained (see Flament, 1981; Doise, Lorenzi-Cioldi, 1992; Moliner, Rateau, Cohen-Scali, 2002; Vergès & Bouriche, 2002; Bouriche, 2003).

In the maximum trees, a measurement of the centrality index can be used to determine the elements with the greatest probability of being central. The centrality index is calculated using the following formula: (Total number of edge indices in which the element is the vertex/total number of indices in the graphs) × 100.

Results

Lexical Analysis

Insert table 1 about here

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[5] Number of participants who uttered the two items in the pattern of the first three ranks of evocation.

[6] Total number of participants who uttered the two items of the pair or just one of the two items of the pair.

The $\chi 2$ analysis comparing the number of Hapax and other words across the three groups reveals a significant difference ($\chi 2$ (2, N=804) = 24.28, p<.0001). A contrast analysis confirms that professional nurses utter fewer Hapax (54) than student nurses (337) ($\chi 2$ corrected (1, N=459) = 18.52, p<.0001) and students not specialized in nursing (312) ($\chi 2$ corrected (1, N=459) = 22.02, p<.0001). No significant statistical differences were found in the number of Hapax produced by the two groups of students ($\chi 2$ corrected (1, N=690 = 0.37, p<.55).

Finally, the number of Hapax related to the number of participants is 0.47 for professionals, 1.06 for specialized students and 0.99 for non-specialized students.

In a parallel manner, a significant difference is observed between the number of words uttered by members of the three groups ($\chi 2$ (2, N=804) = 253.55, p<.0001). A contrast analysis shows that professionals utter a smaller number of different words than specialized students ($\chi 2$ (1, N=459) = 247.40, p<.0001) and non-specialized students ($\chi 2$ (1, N=459) = 201.48, p<.0001). There is no significant difference between the two groups of students in this particular instance.

From these results, it may be concluded that one of the distinguishing characteristics of professional nurses is their use of a smaller number of elements belonging to an individual lexical register, in addition to the production of a less extensive lexicon. These results corroborate the first hypothesis and the notion of operative language (Falzon, 1989).

Insert table 2 about here

The $\chi 2$ analysis comparing the number of consensual words and other words across the three groups shows no significant differences ($\chi 2$ (2ddl) = 0.09; p<.95). Globally, the proportion of consensual words [(Number of consensual words/Number words associated) ×

100] is equally important among professional nurses (6.7%), student nurses (6.6%) and non-specialist students (6.9%). It cannot be concluded that professionals make a greater use of a shared lexicon than the two other groups. This result is in conflict with Hypothesis 1 and the notion of operative language.

Thus, two further issues require analysis: (1) the organization of the connections between the words uttered by the participants in such a way as to assess the structural organization of the representation; and (2) the meaning of the words uttered in order to define the conceptual domain to which they refer.

Analyses of Content and Structure

Comparison of the three groups of participants: The representation of hygiene among Students Not Specialized in Nursing (SNSN).

Insert Figure 1 about here

The graphic representation shows a network of 12 elements in a star-shaped structure. The network is articulated around two different nodes. Cleanliness is the most connected element, with the highest number of edges (8). Its centrality index is 68. Cleanliness is connected with 8 chains of association. The first six chains include just one element: *washing*, *gloves*, *germs*, *cleaning*, *disinfection*, and *health*. The seventh chain contains just two chained elements: *disinfecting* and *bleach*. The eighth chain is structured around a core formed by the element *soap* connected with *disinfectant* and *shower*.

An analysis of the content of this network of associations indicates that for SNSN, hygiene tends to refer to a lexicon related primarily to domestic and body hygiene (*bleach*, *disinfecting*, *disinfectant*, *health*, *germs*, *shower*, *cleaning*, and *soap*...). Note that bleach is no longer used in hospitals, although it is still a product used for domestic purposes. Some

terms may, however, relate to hospital hygiene (*disinfection*, *gloves*) depending on the specific meaning that is attributed to them. Hospital hygiene workers tend not to use the term *disinfectant* to refer to hospital hygiene, preferring instead the phrase *disinfection protocols*. Here *disinfecting* refers to the entire set of measures taken to destroy micro-organisms within the environment. The term can be assumed to have a different meaning when used in the context of domestic and body hygiene. Professionals tend to speak instead of *bacteria*, *viruses* and *mycetes* in referring to the micro-organisms that cause nosocomial infections. The term *germ* tends not to be used (Enjalbert & Vanderveiken, 1987).

The Representation of Hygiene Among Students Specialized in Nursing (SSN)

Insert Figure 2 about here

The graphic representation shows 8 elements in a star-shaped structure. The network is articulated around a single node, *Asepsis*. *Asepsis* is the most connected element, with the highest number of edges (4). Its centrality index is 64.2 and it articulates 4 chains of association: the first includes *cleanliness*, *disinfection* and *decontamination*. The second includes *protocol* and *compliance*. The third contains just one element – *hand-washing*. The fourth also contains just one element – *rigour*.

An analysis of the content of the network of association shows that hygiene refers primarily to one concept, *asepsis*, which is directly related to the lexicon of hospital hygiene. Asepsis refers to a series of care-related procedures that constitute preventative measures directed at inert organisms (the environment) and are designed to prevent the spread of micro-organisms (Enjalbert & Vanderveiken, 1987). The use of a professional lexicon that is specific to hospital hygiene is significant. *Disinfection*, *decontamination*, and *hand-washing*

refer to precise protocols. *Rigour* and *compliance* represent conditions for the effective *application* of these protocols.

The Representation of Hygiene Among Professional Nurses (PRO)

Insert Figure 3 about here

The graphic representation shows a star-shaped network composed of 4 elements. The network is articulated around a single node: *Cleanliness*. Cleanliness is the most connected element, with the greatest number of edges (3). Its centrality index is 100. The concept articulates three elements: *asepsis*, *hand-washing*, and *washing*. All of the elements refer to a lexical field related specifically to hospital hygiene, although the structure of the network is highly refined.

This initial analysis leads to an initial conclusion. As expected, differences are observed between the representations that tend to prevail in the three groups. These differences are apparent in the organization and content of the representations. In terms of the structure, it appears that the prevailing representations among both SNSN and PRO are articulated around the same element (*cleanliness*), while the prevailing representation among SSN is structured around *asepsis*. In terms of content, a more specialized vocabulary articulated around hospital hygiene is used by SSN and PRO. One notable exception is *cleanliness*, which appears in all three representations and is the only element shared by all three groups.

Nevertheless, concepts related to the term *cleanliness* tend to vary across the three different groups. Among SNSN, the term refers to *health*, *washing*, *soap*, *cleaning*, and *germs*. Among PRO, it refers to *asepsis*, *washing* and *hand-washing* and among SSN to *disinfection* and *asepsis*.

A more specific comparison of PRO and SSN indicates that the four elements that make up the prevailing representation among professionals are also found in the representation that prevails among students. It appears that the prevailing representation of hospital hygiene among PRO is tighter and more refined than the prevailing representation of hospital hygiene among students undergoing training in nursing. An analysis of differences in the prevailing representation of hospital hygiene among SSN at the three different levels of training was carried out in order to understand the process governing the evolution of the representation, which appears to be based on a process of reduction and concentration on specific terms.

Intra-group Analyses: A Comparative Analysis of the Three Levels of Training for Students Specialized in Nursing (SSN)

Insert Figure 4 about here

The graph of the representation of first-year students indicates seven elements in a star-shaped structure. The network contains two nodes. The first node corresponds to *Cleanliness*. *Cleanliness* is the most connected element, with the greatest number of edges (5). Its centrality index is 73. An analysis of the network of associations in terms of content clearly highlights a lexicon that pertains almost exclusively to hospital hygiene (*safety*, *decontamination*, *washing*, *asepsis*, *disinfection*, *hand-washing*, and *antiseptic*).

Insert figure 5 about here

The graphic representation highlights seven elements in a chain and cluster structure. The network is articulated around 2 nodes: *cleanliness* and *asepsis*. Cleanliness is the most

connected element, with the greatest number of edges (4). Its centrality index is 53.9. *Cleanliness* is associated with *compliance*, *disinfection*, *prevention* and *asepsis*. *Asepsis* is associated with *hand-washing* and *protocol*.

Insert Figure 6 about here

The graphic representation highlights four elements in a chain structure. *Asepsis* is the most connected element, with the greatest number of edges (2). Its centrality index is 91.2. It is structured around *hand-washing*, on the one hand, and *cleanliness* and *protocol* on the other.

To conclude, the second set of results shows that as students become more highly trained, a specific representation of hospital hygiene tends to emerge, resulting (as predicted) in the use of a more specialized lexicon. In addition, there is a shift from a representation centred on *cleanliness* (a concept also found among non-specialist students) towards a representation articulated around the concept of *asepsis*. Notably, there is a significant evolution in terms of the overall structural organization of the representation.

One striking result is that, as training progresses, there is a decrease in the number of elements that constitute the network of associations. The same decrease was already made clearly apparent by comparing students specialized in nursing and professional nurses, and is also in evidence when comparing the different levels of training. There is a significant decrease between the first two years and the third year of training.

Discussion and Conclusions

First of all, it is important to emphasize the limitations of the procedure used for the purposes of this research. Although precautions were taken to ensure sample homogeneity (in both student groups), it is important to recognize that factors other than those examined in

this research may account for the differences observed between students in the three years of training and between student nurses and professional nurses. Accordingly, we use the expression "*evolution"* of the social representation with caution. Nevertheless, the results of this research open avenues for further theoretical and methodological analyses, particularly in terms of the processes involved in the shift from a common sense social representation of a conceptual domain towards a professional social representation founded on scientific knowledge (particularly in the area of microbiology).

The analyses conducted as part of this research suggest three main results. First of all, an encounter with specialized scientific concepts and the implementation of associated health practices during intermittent clinical placements has an impact on the content and structural organization of the representation of the conceptual domain of hospital hygiene. A shift is observed from a representation structured around a common sense conception of "cleanliness" towards a representation centred on the scientific concept of "asepsis" that pertains specifically to hospital hygiene. Secondly, it can be noted that as training progresses, the prevailing representations at the three levels of experience and training tend to converge around a limited number of elements. The interest of this result is that the reverse hypothesis might be postulated, i.e., as knowledge evolves, the range of mobilized concepts increases, and the more likely it is that a large number of consensual elements will be connected within the representation of the conceptual domain.

This study demonstrates that, as their conceptual knowledge increases and evolves, individuals become increasingly likely to use a smaller number of elements that are more often consensually shared elements. This finding is consistent with the notion of operative language developed by Falzon (1989), who showed that the language used by experts tends to be more restricted than ordinary language. The terms used by experts are rare insofar as they

pertain to a specialized field. It might be assumed, therefore, that they are present within the representation and that they perform a structuring role.

The third main result of this study pertains more specifically to professionals. Oddly, the prevailing representation of hospital hygiene among professional nurses was structured around the concept of cleanliness rather than the concept of asepsis (i.e., the central structural element in the prevailing representation of hospital hygiene among the most advanced students). A more detailed analysis of this result might invoke the notion of operative language. Research carried out by Falzon (1989) shows that the terms which constitute an operative language tend to be monosemic, i.e., they refer to specific, precise meanings. If we closely examine the associative network of concepts in the representations of the nursing professionals and compare them to the non-specialist students, we see a clear distinguishing difference. While the term "cleanliness" is central in both representations, the two representations are clearly associated with different concepts. When professionals use the term "cleanliness", the concept of *asepsis* is implied, i.e., referring to specific protocols. In contrast, the use of the term "cleanliness" by non-specialist students implies markedly different concepts – *washing*, *soap*, *health*, *cleaning*...The findings of this analysis are consistent with the results outlined by Bertels (2008) on technical corpuses. Bertels focused specifically on the semantic heterogeneity of co-occurring words within the same corpus. The results indicate that one of the characteristics of technical language is the use of common sense terms to translate scientific concepts pertaining to the technical field of expertise.

Another explanation might be ventured: it is quite likely that, from a pragmatic point of view, doctors and nurses use the term "cleanliness" to refer to hygiene because the term is likely to be universally understood by students on clinical placements and by patients. In the context of this research, the methodology does not allow us to decipher potential differences in the understanding and use of the term "cleanliness" among each of the three groups:

professional nurses, student nurses, and non-specialist students. An appropriate methodology (e.g., interviews) is required for a more detailed analysis of the meaning attributed to the term in all three groups. A process of data collection is currently being undertaken to address this issue.

The significant decrease of the number of elements at the most consensual level as specialization increases also requires further examination. In fact, this finding could be assessed in connection with research in the area of training for professional competency. Research indicates that experts are characterized by possessing an integrated structural organization of knowledge and expertise. In contrast, novices have more scattered networks of knowledge with fewer articulated interconnections (see Rogalski & Vieillard, 2002; Rogalski, 2003). In other words, an expert's performance is not merely explained by an accumulation of information about the object in question, but is also characterized by the ability to structure knowledge in such a way as to achieve a higher level of recall of information from memory, an improved capacity to make connections across different conceptual domains, and the production of a greater number of responses that are appropriate to the situation at hand (Polanyi, 1962; Newell, 1973). This is precisely the function performed by representations. Interviews and observations of work situations are required to show how this integrated model of knowledge about hygiene tends to operate. Thus, a further process of data collection and analysis is in progress in order to address this need.

Finally, we would like to emphasize the relevance of this research for the training undergone by professional healthcare workers. Our research has highlighted several issues related to the training provided to student nurses in the area of hand hygiene, particularly the importance of the provision of training that is more directly related to the issue of infections transmitted by hand. There needs to be a greater focus on hand hygiene and it must be connected to practice experience.

We suggest that the training needs to be construed in two different ways – by connecting it with training in microbiology and by actual performance of "best practices". This can be carried out using role-play techniques applied to filmed case situations where immediate feedback can be provided on student performance to reinforce successful use of practice skills but also to underline errors. Such training also needs to be supplemented by a more considered reflection on protocols (what professionals call "best practices") by underlining domestic hygiene behaviours that need to be challenged.

A constant oscillation between naive and scientific knowledge needs to be emphasized. Some suggestions for improving training are currently being researched by conducting interviews with healthcare workers (Salès-Wuillemin, Morlot, Masse, Kohler, 2009; Salès-Wuillemin, Morlot, Fontaine, in press, 2010). This research has already highlighted a number of erroneous rules of practice or reasoning, including: "*The more product you use the more efficient it tends to be*" or "*If it smells good, that means it's clean*", or instances of resistance such as "*The more you work in that way (i.e., hygiene protocols), the more germs there are and, therefore, the more nosocomial infections you get because it's too sterile*". These rules are based on false beliefs that are transmitted not only by lay people in the community, but also by some professional nurses during the students' clinical placements in hospitals. It is worth reviewing these types of false beliefs in the course of training in order to call them into question and emphasize more accurate information relative to hygiene protocols. Thus, the discursive data we hope to obtain in our interviews with healthcare workers will be pivotal. They will facilitate the design and development of appropriate training exercises based on concrete situations observed in the field.

References

Abric, J.C. (1994). L'organisation interne des représentations sociales : Système central et système périphérique. In C. Guimelli (Ed.), *Structures et transformations des représentations sociales* (73-84). Neuchâtel, Paris : Delachaux & Nieslé.

Ackyol, A.D. (2007). Hand hygiene among nurses in Turkey: Opinions and practices. *Journal of Clinical Nursing*, *16*, 431-437.

Abric, J.C. (2003) (Ed.) *Méthode d'étude des représentations sociales*. Ramonville: Erès.

Bangerter, A. (1995). Rethinking the relation between science and common sense: A comment on the current state of the SR theory. *Papers on Social Representations/Textes sur les Représentations Sociales*, *4*(1), 1-18.

Bataille, M. (2000). Représentations et implication : des représentations sociales aux représentations professionnelles, in : C. Garnier et M.L Rouquette (Eds.) *Représentations en éducation et formation* (165-189). Montréal : éditions nouvelles.

Bertels, A. (2008). Sémantique quantitative et corpus technique: Des analyses statistiques aux interprétations linguistiques, *9èmes Journées Internationales d'Analyses Statistiques des Données Textuelles,* Lyon, March 12-14, 2008. http://www.cavi.univ-paris3.fr/lexicometrica/jadt/jadt2008/pdf/bertels.pdf

Bouriche, B. (2003). L'analyse de similitude. In J.C. Abric (Ed.), *Méthode d'étude des représentations sociales* (pp. 220-252). Ramonville: Erès.

Brown, J., Chapman, S., & Lupton, D. (1996). Infinitesimal Risk as Public Health Crisis: News Media Coverage at a Doctor-Patient HIV Contact Tracing Investigation, *Social Science and Medicine*, *43*(12), 1685-1695.

Correia, H., Broderick, P., & Walker, I. (2003). Social representations and scientific understandings of the mentally ill: Core themes and evolving differences during psychology education. *Paper presented at the 9th Annual Conference of the Society*

of Australasian Social Psychologists. Bondi, NSW (Abstract In *: Australian Journal of Psychology*, p. 39).

Dardenne, B., Haslam, A., McGarty, C., & Yzerbyt, V. (2001). *La recherche en psychologie, méthodologie et statistiques*. Louvain-La-Neuve: Academia-Bruylant.

Doise, W., Clémence, A., & Lorenzi-Cioldi, F. (1992). *Représentations Sociales et Analyse des Données.* Grenoble : Presses Universitaires de Grenoble.

Durand, C. (2004). L'alternance, dispositif de formation … de quoi parlons-nous? *cadredesanté.com*, http://www.cadredesante.com

Enjalbert, L., & Vanderveiken, F. (1987). *Simple vocabulaire d'hygiène hospitalière*. Paris : Privat.

Falzon, P. (1989). *Ergonomie cognitive du dialogue*. Grenoble : Presses Universitaires de Grenoble.

Flament, C. (1981). L'analyse de similitude : Une technique pour les recherches sur les représentations sociales. *Cahiers de Psychologie Cognitive*,*1*, 375-395.

Flament, C. (1994). Structure, dynamique et transformation des représentations sociales. In J.-C. Abric (Ed.), *Pratiques sociales et représentations* (pp. 37-57). Paris: Presses Universitaires de France.

Foster, J. L. H. (2003). Representational projects and interacting forms of knowledge. *Journal for the Theory of Social Behaviour, 33*(3) 231-244.

Gaudart, C., & Weill-Fassina, A. (1999). L'évolution des compétences au cours de la vie professionnelle : Une approche ergonomique. *Formation emploi*, 67.

Green, E.G., & Clemence, A. (2008). Discovery of the faithfulness gene: A model of transmission and transformation of scientific information. *British Journal of Social Psychology*, *47*, 497-517.

Guimelli, C. (1989). Pratiques nouvelles et transformation sans rupture d'une représentation sociale : La représentation de la chasse et de la nature. In Beauvois, Joulé, Monteil (Eds.), *Perspectives cognitives et conduites sociales : Des attitudes aux attributions sur la construction de la réalité sociale*, Tome 2, (pp. 117-138). Cousset, Delval.

Guimelli, C., & Jacobi, D. (1990). Pratiques nouvelles et transformation des représentations sociales. *Revue Internationale de Psychologie Sociale*, *3*(3), 307-334.

Guimelli, C., & Reynier, J. (1999). Structuration progressive d'une représentation sociale: À propos des infirmières. In C. Garnier & M. L. Rouquette (Eds.), *La genèse des représentations sociales* (pp. 171-181). Montréal: Éditions Nouvelles.

Howarth, C. (2006). ''A social representation is not a quiet thing'': Exploring the critical potential of social representations theory. *British Journal of Social Psychology*, 45, 65–86.

Jodelet, D. (1991). *Madness and Social Representations*. London: Harvester/Wheatsheaf.

Jodelet, D., (1989) (Ed.). *Les représentations sociales*. Paris : Presses Universitaires de France.

Joffe, H. (2002). Social representations and health psychology. *Social Science Information*, *41*(4), 559-580.

Jovchelovitch, S. (2007). *Knowledge in Context: Representations, community and culture*, London: Routledge.

Kelman, H. C. (1958). Compliance, identification and internalization: Three processes of attitude change. *The Journal of Conflict Resolution*, *1*, 51-60.

Labbé, S., Ratineau, P., & Lac, M. (2007). Dynamique des implications et des représentations professionnelles: Le cas d'une recherche action dans le milieu industriel. *Actes du Congrès International AREF (Actualité de la Recherche en*

Education et Formation), Strasbourg, 11p., (téléchargé le 10 octobre 2009) http://www.congresintaref.org/actes_pdf/AREF2007_Sabrina_LABBE_256.pdf

Lavigne, C. (1996). Les représentations sociales de la folie: Etude du conflit entre connaissance savante et connaissance traditionnelle dans le contexte pluriculturel vénézuélien. *Cahiers Internationaux de Psychologie Sociale*, *29*, 39-63.

Lebart, L., & Salem, A. (1988). *Analyse statistique des données textuelles*. Paris : Dunod.

Lecigne, A., & Quintard, B. (2008). Mettre en place de bonnes pratiques de soins: « Des actes aux idées », *Médecine et Maladies Infectieuses*, *38*, S82-S84.

Lusardi, G. (2007). Hand hygiene: A small study on nursing students' experiences of hand hygiene on clinical placement suggests that students have few positive role models, *Nursing Management*, *14*(6), 26-33.

McGuckin, M., Waterman, R. & Govenik, J. (2009). Hand hygiene compliance rates in the United-States: A one-year multicenter collaboration using product usage measurement and feedback. *American Journal of Medical Quality Onlinefirst*, 20, 10, 40, 1-9.

Moliner P., (2001). *La dynamique des représentations sociales*. Collection: Vies Sociales. Grenoble : Presses Universitaires de Grenoble.

Moliner, P., Rateau, P., & Cohen-Scali, V. (2002). *Les représentations sociales: Pratique des études de terrain*. Grenoble: Presses Universitaires de Grenoble.

Moliner, P., Joule, R.V., & Flament, C. (1995). Essai contre attitudinal et structure des représentations sociales. *Cahiers Internationaux de Psychologie Sociale*, *27*, 44-55.

Moliner, P. (1998). Dynamique naturelle des représentations sociales. *Cahiers Internationaux de Psychologie Sociale*, *40*, 62-70.

Morin, M. (1999). Emergence du Sida et transformation des représentations sociales. In M. L Rouquette & C. Garnier (Eds.), *La genèse des représentations sociales* (pp. 14-41). Montréal : Éditions Nouvelles.

Morlot, R., & Salès-Wuillemin (2008). Effet des pratiques et des connaissances sur la représentation sociale d'un objet: Application à l'hygiène hospitalière, *Revue Internationale de Psychologie Sociale*, *21*(4) 89-114.

Moscovici, S. (1961). *La psychanalyse, son image et son public*. Paris: Presses Universitaires de France (2ème édition, 1976).

Moscovici, S. & Hewstone, M. (1983). Social representations and social explanations: From the « naive » to « amateur » scientist. In M. Hewstone (Ed.), *Attribution theory: Social and functional extensions* (pp. 98-126). Oxford: Blackwell.

Moscovici, S., Vignaux, G. (1994). Le concept de Thêmata, in : Ch. Guimelli (Ed.). *Structure et transformation des représentations sociales* (pp. 25-72). Neuchâtel : Delachaux et Nieslé.

Mugny, G., Moliner, P. & Flament, C. (1997). De la pertinence des processus d'influence sociale dans la dynamique des représentations sociales: Une étude exploratoire, *Revue Internationale de Psychologie Sociale, 10*(1) 31-49.

Newell, A. (1973). Production systems: Models of control structures. In W. G. Chase (Ed.), *Visual information processing* (pp. 463-526). New York: Academic Press.

Perrenoud, P. (2001). Articulation théorie et pratique et formation de praticiens réflexifs en alternance. In P. Lhez, D. Millet, & B. Seignier (Eds.), *Alternance et complexité en formation* (pp. 46-67). Seli Arslan.

Pessoa-Silva, C., Posfay-Barbe, K., Pfister, R., Touveneau, S., Perneger, T., & Pittet, D. (2005). Attitudes and perceptions toward hand hygiene among healthcare workers

caring for critically ill neonates. *Infection Control and Hospital Epidemiology, 26*(3), 305-311.

Piaser, A. (1999). Représentations professionnelles à l'école, particularités selon le statut : Enseignants, inspecteurs. *Thèse de doctorat en sciences de l'éducation*. Toulouse Le Mirail.

Pittet, D., Simon, A., Hugonnet, S., Pessoa-Silva, C.L., Sauvan, V., & Perneger, T.V. (2004). Hand hygiene among physicians: Performance, beliefs, and perceptions. *Annals of Internal Medecine, 141*, 1-8.

Polanyi, R. (1962). Tacit knowledge and its bearing on some problems of philosophy. *Review of Modern Physics*, *34*, 601-615.

Rogalski, J. (2004). La didactique professionnelle: Une alternative aux approches de « cognition située » et « cognitiviste » en psychologie des acquisitions, *@ctivités*, *1*(2)103-120. http://www.activites.org/

Rogalski, J., &Vieillard, L. (2002). Articulation entre différents types de connaissances. In A. Tiberghien (Ed.), *Du savoir naïf au savoir scientifique* (pp. 51-79). Synthèse Cognitique, Ecole et sciences cognitives, Ministère de la Recherche.

Roussiau, N., & Soubiale, N. (1996). Approche expérimentale de la modification d'une représentation sociale sous l'effet de la communication d'un message. *Bulletin de Psychologie*, XLIX, *422*, 88-99.

Salès-Wuillemin, E., (2005). *Psychologie sociale expérimentale de l'usage du langage, représentations sociales, catégorisation et attitudes: Perspectives nouvelles*. Paris : L'Harmattan.

Salès-Wuillemin, E., Morlot, R., & Fontaine, A. (in press, 2010). La représentation de l'hygiène chez les personnels soignants. In Castel, P., Salès-Wuillemin, E., &

Lacassagne, M.F., (Eds.), *Psychologie sociale, communication et langage*. Liège : De Boeck.

Salès-Wuillemin, E., Morlot, R., Masse, L., & Kohler, C. (2009). La représentation sociale de l'hygiène chez les professionnels de santé: Intérêt du recueil par entretien et de l'analyse discursive des opérateurs de liaison issus du modèle des schèmes cognitifs de base (SCB). *Cahiers Internationaux de Psychologie Sociale, 81, 43-72.*

Tafani, E. (2001). Attitude, engagement et dynamique des représentations sociales: Études expérimentales. *Revue Internationale de Psychologie Sociale*, *14*(1), 7-29.

Tafani, E., & Souchet, T. (2002). Commitment in pro-versus contra-attitudinal practices and social representation dynamics. *Swiss Journal of Psychology*, *61*(1), 34-44.

Vergès, P., & Bouriche, R. (2001). L'analyse des données par les graphes de similitude. *Sciences Humaines*, 1-90. http://www.scienceshumaines.com/textesInedits/Bouriche.pdf

Vergely, P. (2004). *Analyse linguistique de l'expression du dysfonctionnement technique: Le cas des échanges entre chefs de salle et maintenance opérationnelle dans la navigation aérienne*, Thèse de doctorat en Sciences du Langage. Université Toulouse- Le Mirail, October 18, 2004.

Zérillo, S. (1998). *Analyse structurale d'une représentation sociale: l'hygiène*, Thèse de Doctorat, Université Paul Valéry Montpellier 3, Presses Universitaires du Septentrion.

Tables to be inserted

(The figures are presented in six separate files)

Table1: Assessment of intra-group variability. A comparative overview of the number of Hapax in the three groups of participants (Professional nurses, Student Specialized in Nursing, Students Non Specialized in Nursing)

Groups	**PRO[(a)] (1) N=114**	**SSN[(b)] (2) N=315**	**SNSN[(c)] (3) N=315**	$\chi 2$ **(2ddl) 1/2/3**	$\chi 2$ **(1ddl) 1/2**	$\chi 2$ **(1ddl) 1/3**	$\chi 2$ **(1ddl) 2/3**
Hapax	54	337	312	24,28 ; p<.0001	18,52 ; p<.0001	22,02 ; p<.0001	0,37 ; p<.55
Other words	75	197	167				
TOTAL	129	534	479	=253,55 ; p<.0001	=247,40 ; p<.0001	=201,48 ; p<.0001	=2,99 ; p<.08

Note.

(a) Qualified professional nurses: PRO,

(b) Students Specialized in Nursing: SSN

(c) Students at the same level of training but Not Specialized in Nursing: SNSN

Table 2: Assessment of intra-group consensus. A comparative view of the number of consensual words within the three groups of participants (Professional nurses, Student Specialized in Nursing, Students Non specialized in Nursing)

Groups	**N=**	**Associable words**	**word associated**	**K=**	**Binomial test**	**Retained words**	**Excluded words**
PRO[(a)]	114	10	129	22 (22/114=19,29 %)	p<.0001	8	121
SSN[(b)]	315	10	534	17 (18/315=17,36 %)	p<.0001	35	499
SNSN[(c)]	315	10	479	18 (18/315=17,29 %)	p<.0001	33	446

Note. The values represent number of words

(a) Qualified professional nurses: PRO,

(b) Students Specialized in Nursing: SSN

(c) Students at the same level of training but Not Specialized in Nursing: SNSN

Figure 1: Extract of maximum tree – Students Non Specialized In Nursing (SNSN)

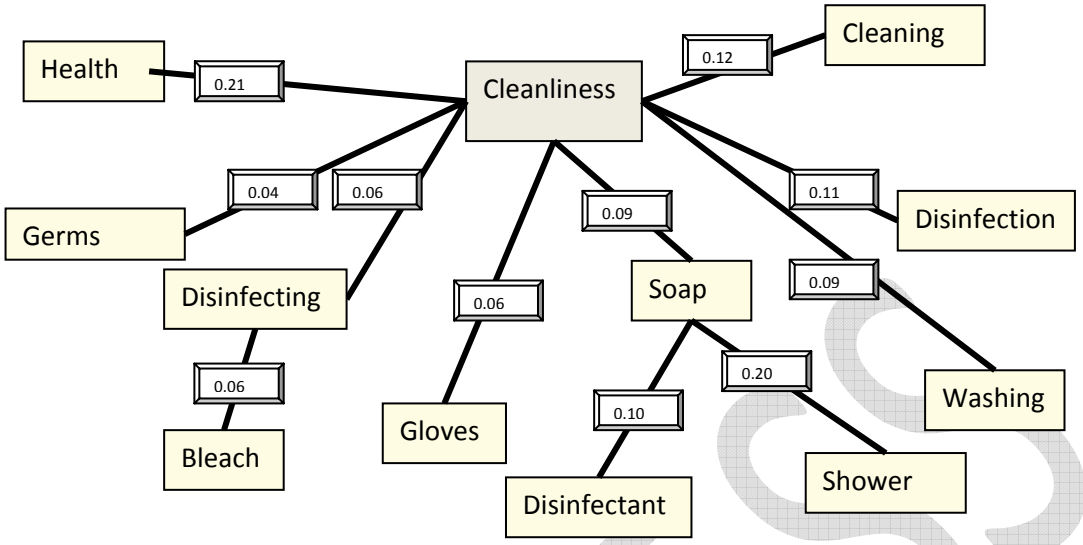

Figure 2: Extract of maximum tree – Student Specialized in nursing (SSN)

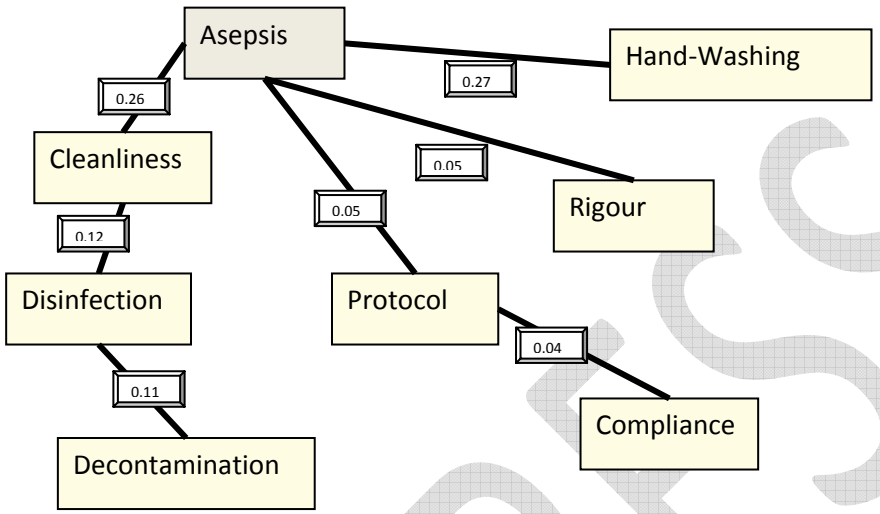

Figure 3: Extract of maximum tree – professionals (PRO)

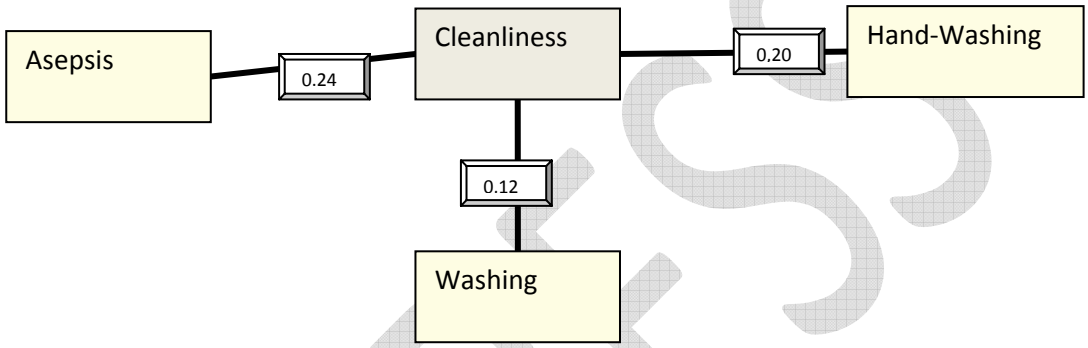

Figure 4: Extract of maximum tree – Student Specialized in Nursing, SSN (year 1)

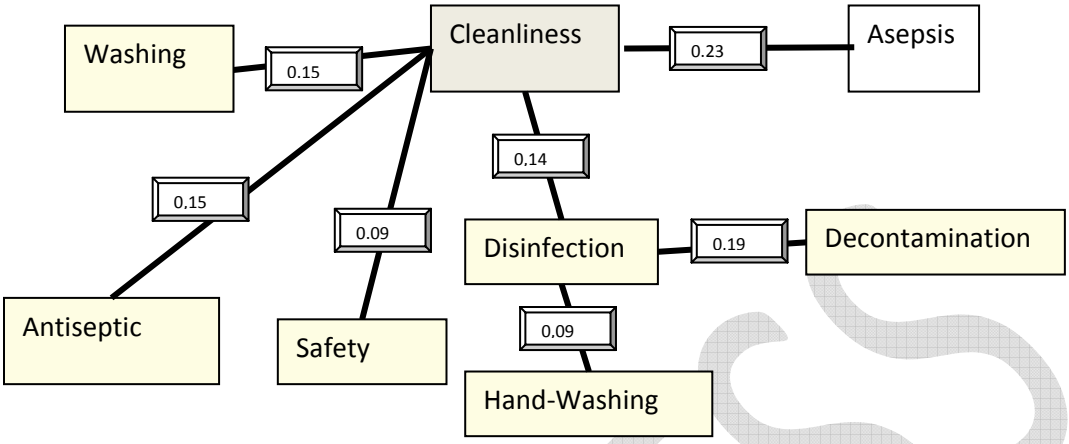

Figure 5: Extract of maximum tree – Student Specialized in Nursing, SSN (year 2)

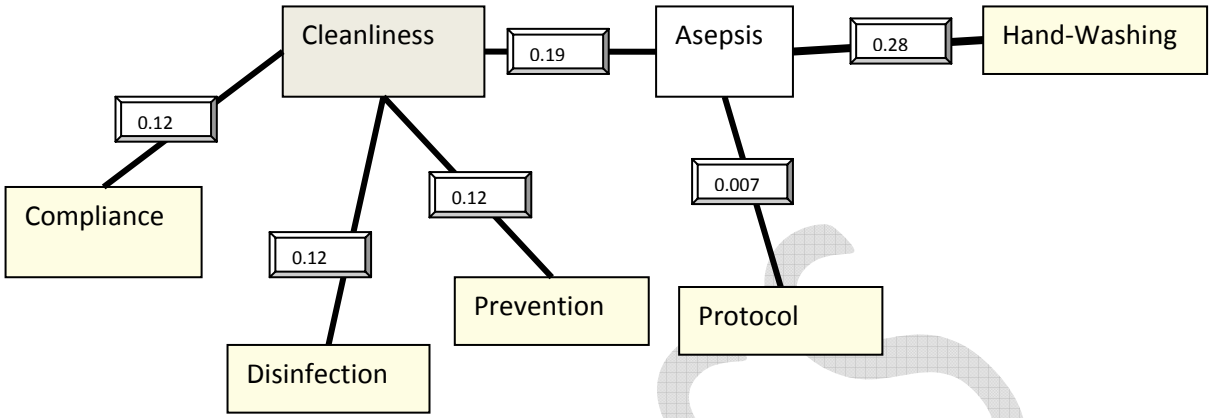

Figure 6: Extract of maximum tree – Student Specialized in Nursing, SSN (year 3)